Review of the California Ambient Air Quality Standards For Particulate Matter and Sulfates

Report to the Air Quality Advisory Committee

Public Review Draft

November 30, 2001

California Environmental Protection Agency

Air Resources Board
and
Office of Environmental Health and Hazard Assessment

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1 Executive Summary

In December 2000, as a requirement of the Children's Environmental Health Protection Act (Senate Bill 25, authored by Senator Martha Escutia, Stats. 1999, Ch. 731), the California Air Resources Board (ARB or Board), approved a report (ARB and OEHHA, 2000), developed in consultation with the Office of Environmental Health Hazard Assessment (OEHHA), that contained a preliminary review of all of the existing health-based California ambient air quality standards. There were two purposes for these reviews: (1) to determine whether, based on public health, scientific literature, and exposure pattern data, the existing ambient air quality standards adequately protected the health of the public, including infants and children, with an adequate margin of safety [California Health & Safety Code section 39606(d)(1)]; and (2) to prioritize for full review those standards determined not to adequately protect public health.

These reviews were not exhaustive, but rather were narrowly targeted to the two purposes noted above. The critical reviews suggested that adverse health effects may occur in infants, children, and other potentially susceptible subgroups exposed to pollutants at or near levels corresponding to several existing California ambient air quality standards. The reviewers recommended, and the Board concurred, that among the standards deemed possibly inadequate, the standards for particulate matter less than 10 microns in aerodynamic diameter (PM10) should be the first to undergo full review. Recent epidemiological literature on PM10 suggests the potential for health effects in infants and children, including mortality, reduced birth weight, premature birth, asthma exacerbation, and acute respiratory infections. Epidemiological studies suggest that increased mortality and hospital admissions among the elderly and those with chronic heart and lung diseases may also be associated with exposure to PM10. Further, since almost everyone in California is exposed to levels at or above the current State PM10 standard during some parts of the year, the statewide potential for significant health impacts associated with PM exposure was determined to be large and wide-ranging. Finally, the reviewers recommended, and the Board concurred, that the standard for sulfates should be reviewed in conjunction with the PM10 standards since sulfates are a component of particulate matter.

In this report, the staff of the ARB and OEHHA present the findings of their full review of the public health, scientific literature, and exposure pattern data for PM and sulfates in California.

The scientific evidence suggests a need for standards to encompass fine particles (PM2.5, particulate matter 2.5 microns or less in aerodynamic diameter) as well as PM10. PM2.5 and PM10 are both associated with a wide range of serious adverse health outcomes, including premature mortality, acute and chronic bronchitis, asthma attacks and emergency room visits, upper respiratory symptoms, days of work loss, and days with some restrictions in activity.

California Ambient Air Quality Standards have four elements (California Health and Safety Code Section 39014, and Title 17, California Code of Regulations, Article 2, Section 70101): (1) definition of the air pollutant, (2) an averaging time, (3) a pollutant concentration, and (4) a monitoring method to determine attainment of the standard. **Staff's recommendations for each of these elements are summarized below**:

- PM10 Annual-average Standard – Lower the annual-average standard for PM10 from 30 micrograms per cubic meter ($\mu g/m^3$) to **20 $\mu g/m^3$**. Revise the averaging method to an annual arithmetic mean.
- PM10 24-hour-average Standard – Retain the 24-hour-average standard for PM10 at **50 $\mu g/m^3$**.

- PM2.5 Annual-average Standard – Establish a new annual-average standard for PM2.5 at **12 µg/m^3**. Establish the new PM2.5 standard as an annual arithmetic mean.
- PM2.5 24-hour-average Standard – Make no recommendation at this time.
- Sulfate 24-hour-average Standard – Retain the 24-hour-average standard for sulfates at **25 µg/m^3**.
- For all the particulate matter ambient air quality standards, the concentrations for the standards noted above are established as "**not to be exceeded**".

Although staff does not recommend establishing a PM2.5 24-hour-average standard at this time, we recognize that PM2.5 exposures do have significant, short-term health impacts. PM2.5 exposures have been associated with acute mortality effects. Staff is also interested in health impacts from PM2.5 and PM10 at less than 24-hour exposure periods (e.g., hourly average PM standards). While there are compelling studies which associate long-term PM2.5 exposure to increased mortality and morbidity effects, there are fewer studies of the effects from short-term exposures. During the next cycle of review of the PM standards, a larger database of PM2.5 studies will be available to evaluate the basis for potential short-term PM2.5 effects and standards. At that time, staff will again evaluate the potential for short-term PM2.5 standards. Until then, the 24-hour average PM10 standard should provide protection from 24-hour-average PM2.5 peaks and effects.

A quantitative risk assessment estimates that moving current levels of PM10 and PM2.5 in California to attainment of the recommended standards would result in a reduction of 6,500 (3,200 – 9,800 for a 95 percent confidence interval) cases of premature mortality per year, or about 3 percent of all mortality in the population above age 30. The corresponding mean annual reductions in hospitalizations are 600 for chronic obstructive pulmonary disease (COPD), 900 for pneumonia, 1,500 for cardiovascular disease, and 500 for asthma cases. Among children ages 7 to 14, attainment of the PM2.5 standard is estimated to result in about 209,000 (81,000 – 323,000 for a 95 percent confidence interval) less days of lower respiratory symptoms per year. The sulfates standard is currently attained throughout California.

The monitoring methods to determine attainment are summarized below.

- PM10 Monitoring Method – Staff recommends that the State monitoring method for PM10 (Method P) be updated to remove some of its dated operational and design features, and bring the State and federal reference samplers into alignment. This action will allow well-tested, federally approved instruments to be used as part of the State's PM program, and takes advantage of the already extensive PM10 monitoring network.
- PM2.5 Monitoring Method – For the PM2.5 annual-average standard, the staff proposes to adopt the Federal Reference Method (FRM) for PM2.5 as the method for California. The instruments identified in the PM2.5 FRM have performed well, and are suitable for determining compliance with the air quality standard. The U.S. Environmental Protection Agency (EPA) has funded more than 80 PM2.5 samplers in California that have become the backbone of the State's network.
- Continuous PM Monitoring Methods – There is an increasing need for continuous PM monitors, both Statewide and throughout the nation. These monitors require fewer staff to operate, display PM concentrations in real-time for public warnings, monitor every day, and better identify sources. In addition, their measurements allow for more refined estimates of exposure in community health studies and they are capable of collecting the ambient data needed to establish and determine compliance with possible future hourly average PM standards. The biggest problem so far has been the ability of the continuous samplers to

produce results comparable to the reference samplers. Deployment has been slow in California for PM10 because the continuous samplers on the market in the last ten years generally performed poorly in many high PM areas of the State. Advances have been made, and tests have been recently conducted in the State, that may make it possible to approve continuous samplers. Staff is proposing to adopt either a sampler type, or principle of operation for continuous samplers.

- Sulfate Monitoring Method – Staff recommends that the current total suspended particle (TSP) sulfate method (which employs a high volume sampling with analysis by ion chromatography), described in the ARB method MLD 033, be changed to an existing method for PM10 sulfates, MLD 007. MLD 007 is based on high-volume SSI sampling and ion chromatography. This change would allow California to take advantage of its existing PM10 sulfates network.

In light of the adverse health effects observed at current ambient concentrations and the lack of a demonstrated threshold, staff makes the following comments:

- In any air basin in California that currently attains the ambient air quality standards, for either PM10 or PM2.5, the air quality should not be degraded from present levels.
- The ARB, in consultation with local air quality management districts, establishes a goal of continued reductions in PM10 and PM2.5 concentrations over time.
- The standards be revisited within five years, in order to re-evaluate the evidence regarding the health effects associated with particle size, chemistry, and concentration.

The proposed ambient air quality standards will in and of themselves have no environmental or economic impacts. Standards simply define clean air. Once adopted, local air pollution control or air quality management districts are responsible for the adoption of rules and regulations to control emissions from stationary sources to assure their achievement and maintenance. The Board is responsible for adoption of emission standards for mobile sources. A number of different implementation measures are possible, and each could have its own environmental or economic impact. These impacts must be evaluated when the control measure is proposed. Any environmental or economic impacts associated with the imposition of future measures will be considered if and when specific measures are proposed.

The staff recommendations in this Staff Report will be presented for review and comment at public workshops on the following dates:

- December 3, 2001 (evening), Oakland
- December 7, 2001 (afternoon), Sacramento
- December 11, 2001 (evening), Bakersfield
- December 12, 2001 (evening), Mira Loma
- December 18, 2001 (afternoon), El Monte
- December 18, 2001 (evening), Huntington Park

Further details on the addresses and times of the workshops are available at the ARB website: http://www.arb.ca.gov/research/aaqs/std-rs/std-rs.htm or by calling 916-445-0753.

A public meeting of the Air Quality Advisory Committee (AQAC), a University of California-appointed external committee formed to peer review this Staff Report, will be held on January 23 and 24, 2002 in Berkeley, California. Further details are available at the ARB website: http://www.arb.ca.gov/research/aaqs/std-rs/std-rs.htm or by calling 916-445-0753.

Written comments on this Staff Report and the recommended standards may be addressed to Dr. David Mazzera at the Air Resources Board, Research Division, P.O. Box 2815, Sacramento, CA 95612-2815 (dmazzera@arb.ca.gov, 916-445-9488, 916-322-4357 FAX) by December 31, 2001 for consideration by the Air Quality Advisory Committee at their meeting on January 23 and 24, 2002.

Following the meeting of the Air Quality Advisory Committee (AQAC), staff will revise this Staff Report based on comments received from AQAC members and the public. The revised Staff Report will then be made available for a 45-day public comment period in advance of a public meeting of the Air Resources Board to consider the staff's final recommendations. The Board meeting is tentatively scheduled for May 16, 2002.

1.1 Reference

Air Resources Board and Office of Environmental Health Hazard Assessment (2000). Adequacy of California Ambient Air Quality Standards: Children's Environmental Health Protection Act. Staff Report. Sacramento, CA. Available at http://www.arb.ca.gov/ch/ceh/airstandards.htm.